REMARKS

Claims 1 - 8 and 10 - 13 are pending in the present Application. Claims 14 - 19 have been withdrawn from consideration. Claim 1 has been amended, leaving Claims 1 - 8 and 10 - 13 for consideration upon entry of the present Amendment. Support for the amendment can be found in at least Example 1 of the present application. Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim 1 has been amended to better define the invention. Support for the amendment to Claim 1 can be found on page 10, paragraph [0033] where it is stated that carbon nanotubes may be added in amounts of greater than or equal to about 0.5 wt% and less than or equal to about 5 wt%, of the total weight of the composition.

Support for the use of the term "melt" in melt blending can be found in paragraph [0041] on page 13.

Claim Rejections Under 35 U.S.C. § 102(b) or § 103(a)

Claims 1 - 8, 10 and 13 stand rejected under 35 U.S.C. § 102(b), as allegedly being anticipated by U.S. Patent No. 6,388,046 to Campbell et al. (Campbell) (Office Action dated 10/12/2006, page 3)

To anticipate a claim, a reference must disclose each and every element of the claim. *Lewmar Marine v. Varient Inc.*, 3 U.S.P.Q.2d 1766 (Fed. Cir. 1987).

In making the rejection, the Examiner has stated that "[I]n the alternative that the disclosure by Campbell be insufficient to arrive at the limitations of the instant claims by the applicants, it would have been obvious to optimize the process conditions including viscosity with reasonable expectation of success, because the prior art is concerned about reducing the viscosity and teaches the benefits of reduced viscosity with improved processability." (Office Action dated 10/12/2006, page 4) Applicants respectfully disagree with the rejection under 35 U.S.C. § 102(b) or in the alternative under § 103(a). Applicants respectfully disagree on the grounds that Campbell does not teach the invention with any particular degree of specificity.

The present application is directed to a method for manufacturing a composition comprising blending a polymeric resin, carbon nanotubes and a plasticizer at a viscosity effective to maintain the ratio of resistivity in the direction parallel to a flow direction to that in the direction perpendicular to the flow direction to be greater than or equal to about 0.15; the carbon

nanotubes being present in an amount of about 0.5 wt% to about 5 wt%, based on the total weight of the composition; wherein the blending involves heating the polymeric resin to a temperature greater than its glass transition temperature or to a temperature greater than its melting temperature.

Campbell teaches resin compositions comprising a thermoplastic resin and at least one phosphoramide having a glass transition temperature of at least 0°C. (see abstract) Campbell teaches that viscosity modifying agents can be added to the thermoplastic resin. (see Col. 5, lines 50 – 53; see too Col. 6, line 31 – Col. 15, line 25) Campbell provides a laundry list of additives as shown below:

> The compositions of the invention may also contain other conventional additives including antistatic agents, stabilizers such as heat stabilizers and light stabilizers, inhibitors, plasticizers, flow promoters, fillers, mold release agents, impact modifiers, and anti-drip agents. The latter are illustrated by tetrafluoroethylene polymers or copolymers, including mixtures with such other polymers as polystyrene-co-acrylonitrile (sometimes referred to herein as styrene-acrylonitrile copolymer). Representative examples of fillers include glass fibers, carbon fibers, carbon nanotubes, carbon black, mica, clay, nanoclay, barium sulfate, antimony oxide, titanium dioxide, wollastonite, silica, and talc. Representative examples of mold release agents include pentaerythritol tetrastearate, octyl behenate, and polyethylene. Representative examples of impact modifiers include polybutene and core-shell materials such as poly(methyl methacrylate)-co-poly(butyl acrylate)-co-poly(dimethylsiloxane). In certain embodiments of the invention preferred additives include low molecular weight hydrocarbons with molecular weight between about 500 and 1000 such as ARKON available from Arakawa Chemical USA, and terpenephenols.

(Col. 15, lines 1 – 16)

While the laundry list shown above contains electrically conductive fillers, Campbell does not teach electrically conductive compositions. More specifically, Campbell does not teach either an upper or a lower limit for its additives. The Examiner has conveniently pointed out a value of 2.75 parts as the amount of additive present. (see office action dated 10/12/2006, page 3, lines 6 – 7) The additives added at 2.75 parts were however titanium dioxide and polytetrafluoroethylene, both of which are electrically insulating. (see Example 7) A further review of the Examples shows that

Campbell has used additives such as polytetrafluoroethylene in an amount of 0.4 parts (see Example 1) to glass fibers at 20 parts (see Example 12). The large list of additives (most of which are not electrically conductive and some of those that are electrically conductive such as carbon black will not even show the claimed effect) along with the large ranges for the amounts of additives that can be added clearly indicate that Campbell cannot anticipate the claimed invention within the meaning of 35 U.S.C. § 102. In addition, the list of additives disclosed by Campbell contains a large number of low aspect ratio fillers, which the presently claimed method of processing would have no effect upon.

Since Campbell does not explicitly teach carbon nanotubes and does not teach any examples with a suitable range of electrically conductive filler where the claimed effect can be observed, it cannot anticipate the claimed invention.

In this regard, the courts have held that "[A] reference must provide a disclosure with "sufficient specificity" to constitute a description of the claimed composition within the purview of 35 U.S.C. § 102(b)." *See In re Schaumann*, 572 F.2d 312, 315, 197 USPQ 5, 8 (CCPA 1978).

Applicants therefore respectfully request a withdrawal of the anticipation rejection against Claims 1-8, 10 and 13, because Campbell lacks sufficient specificity to constitute a description of the claimed composition within the purview of 35 U.S.C. § 102(b).

With regard to the alternative rejection under 35 U.S.C. § 103(a), one of ordinary skill in the art upon reading Campbell would not be appraised of the synergistic results obtained with the aspect ratio of the carbon nanotubes and the lowered viscosity of the polymeric resin. Campbell does not disclose any effect of the lowered viscosity on the dispersion of the filler. This has been acknowledged by the Examiner. (Office Action dated 10/12/2006, page 3) Even where Campbell experiments with high aspect ratio fillers (e.g., glass fibers in Example 12, Table 5), it does not describe the preservation of aspect ratio, which in turn leads to the claimed property of a resistivity ratio of greater than or equal to about 0.15. In addition, there is no indication that the reduced viscosity described by Campbell would be adequate to preserve the aspect ratio in the glass fibers described in Campbell.

Since Campbell does not teach a synergy between the low viscosity and the preservation of aspect ratio of carbon nanotubes, one of ordinary skill in the art upon reading Campbell would not be

motivated to try the carbon nanotubes from the large list of additives provided by Campbell in a low viscosity composition. In addition, since Campbell provides no guidance as to the quantity of conductive filler required to produce an electrically conductive composition, one of ordinary skill would not be able to estimate the amount of carbon nanotubes that must be used in order to arrive at the claimed properties.

Finally, one of ordinary skill in the art would not be appraised as to any expectation of success upon reading Campbell. As can be seen in the Examples 1 and 2 of the present application, the addition of a low viscosity additive not only produces lower levels of electrical resistivity, but also homogenizes the electrical resistivity across the length and breadth of the composition. This result is unexpected. In this regard, the courts have held that "[A]n applicant can rebut a prima facie case of obviousness by presenting comparative test data showing that the claimed invention possesses unexpectedly improved properties or properties that the prior art does not have." *In re Dillon*, 919 F.2d 688, 692-93, 16 U.S.P.Q.2d 1987, 1901 (Fed. Cir. 1990).

The synergistic effect disclosed in the examples of the present application, exists only at certain weight percentages of the carbon nanotubes, based on the total weight of the composition. At very low weight percentages of carbon nanotubes, the composition does not display any electrical conductivity, since there is no connectivity between the carbon nanotubes. At very high percentages, there is no synergy between the viscosity reducing additive and the carbon nanotubes since there the weight percent of carbon nanotubes is large enough to mitigate the effects of a better dispersion and the preservation of aspect ratios.

This can be seen in the Figures 5 and 7 of the present application. As can be seen in the Figure 5, when 3 wt% carbon nanotubes are added to the composition (with and without the diluent), the electrical conductivity displayed by the respective compositions is almost identical. Similarly, in the Figure 7, the compositions containing the high and low molecular weight nylon (with the addition of the calcium stearate) show identical electrical conductivity when 3 wt% of carbon nanotubes are added to the composition.

While the compositions that contained water in the Figure 7 display divergent electrical conductivities, it is expected that these too would display identical electrical conductivity as the amount of the carbon nanotubes was increased beyond 3 wt%.

Applicants would like to draw the Board's attention to Figures 1 and 2 of Appendix A.

These figures relate to Percolation Theory, which is used to explain the relationship between the connectedness of clusters of an electrically conducting filler dispersed in an electrically insulating matrix and the measured electrical conductivity of the resulting composition. The Figures 1 and 2 relate to Example 4 of the present application.

Figure 1 of Appendix A, shows exemplary depictions (1) through (6) of a section of an insulating polymeric resin as increasing quantities of an electrically conducting filler are dispersed in the polymeric resin. Figure 1 depicts a section of the insulating polymeric resin without any filler. Since the polymeric resin does not contain any electrically conducting filler, the electrical resistivity measured across the surface MN and the surface OP is very high as depicted by the location of point (1) on the curve in the Figure 2.

Depiction (2) of Figure 1 shows the electrical conductivity of the composite when a small amount of an electrically conducting filler is dispersed in the polymeric resin. Since the clusters of the electrically conducting fillers do not contact each other, there is still no electrical conductivity measured across the surface MN and the surface OP. This is because the amount of the electrically conducting filler is small enough to not form a percolating network across the depicted section. A percolating network is one where there is at least one continuous electrical filler network that contacts the surfaces MN and OP of the section of the composite. This electrically insulating behavior demonstrated by the composite is depicted by portion (1)-(2) of the curve in the Figure 2. The portion (1)-(2) of the curve in the Figure 2 is a plateau whose value in ohm-centimeters would be equal to that of the polymeric resin.

As more electrically conductive filler is added to the composite, the amount of filler reaches the percolation threshold, a percolating network is formed, and the composite now begins to show electrical conductivity as indicated by the depiction (3) in Figures 1 and 2 respectively. With regard to the Figure 2, at location (3) (also indicated by line XX′) there is an increase in electrical conductivity measured across the surfaces MN and OP. With the increase in filler content, there is a further increase in electrical conductivity as seen by the depiction (4) in the Figure 1 and the corresponding location of (4) (also indicated by the line YY′) in the Figure 2. This increase in electrical conductivity is represented by the dotted line between the lines XX′ and YY′.

With further increases in the filler content as seen in the depiction (5) of Figure 1, there is only a very modest increase in the electrical conductivity of the composite as seen by the location of (5) in the Figure 2. Additional increases in the filler content as witnessed by the depiction (6) in Figure 1 do not result in further increases in electrical conductivity as seen by the location of (6) in the Figure 2. Thus, once a steady state of electrical conductivity is reached as witnessed by the point (5) on the percolation curve, the further addition of electrically conducting filler does not produce further increases in the electrical conductivity in the composite. The portion (5)-(6) of the curve in the Figure 2 is also a plateau whose conductivity in ohm-centimeters would be approximately equal to the conductivity of the electrically conductive filler added to the polymeric resin.

Thus, Campbell in not teaching an effective amount of filler, does not teach the invention with any degree of specificity. Campbell therefore cannot anticipate the claimed invention, or in the alternative, render the invention obvious. Applicants believe that the Examiner has not made a prima facie case of obviousness over Campbell and therefore respectfully request a withdrawal of the rejection and an allowance of the claimed invention.

Claims 11 and 12 stand rejected under 35 U.S.C. § 102(b) or in the alternative under 35 U.S.C. § 103(a), as allegedly being anticipated by Campbell. (Office Action dated 10/12/2006, page 4) Applicants respectfully traverse this rejection for the reasons explained above notably that Campbell does not teach the claimed invention with any specificity. While Campbell teaches enhanced processability based upon the reduced viscosity, it does not teach a product containing carbon nanotubes that displays a uniformity of electrical properties in all directions. As noted above, the Examples of Campbell use glass fibers that have macroscopic dimensions as opposed to carbon nanotubes that have diameters in the nanometer range. For these reasons, it is believed that the examples of Campbell that the Examiner has relied upon will not produce the claimed invention. Campbell therefore cannot anticipate the claimed invention and does not render it obvious either.

Claim 13 is rejected under 35 U.S.C. § 102(b) or in the alternative under 35 U.S.C. § 103(a), as allegedly being anticipated by U.S. Patent No. 5,445,327 to Creehan (Office Action dated 10/12/2006, page 4)

Creehan teaches a compounding process for preparing a composite that includes introducing one or more fillers and a matrix material into a stirred ball mill and subjecting the fillers and the matrix material to a combination of shear and impact forces under reaction conditions including reaction time sufficient to reduce the size of agglomerates formed by the fillers to a value below a pre-determined value to disperse the fillers throughout the matrix material. (see Abstract) Creehan does not teach melt blending or heating the matrix material above its glass transition temperature as is presently claimed. In its example (see Table 1), Creehan uses dry ice to embrittle the material. (Col. 4, lines 5 – 8) For this reason at least Creehan cannot anticipate the claimed invention.

Since Creehan does not teach all elements of the claimed invention, the Examiner has not made a prima facie case of obviousness over Creehan. Applicants therefore respectfully request a withdrawal of the rejection and an allowance of the claimed invention.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and withdrawal of the rejections and allowance of the case are respectfully requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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